PHYS040B: **Unofficial Formula Sheet**

CREATED BY: Stephen Iota (siota001@ucr.edu)
LAST UPDATED: May 7, 2019

0 General relationships

$$\mathbf{F}_{\text{net}} = m\frac{\mathrm{d}^2\mathbf{x}}{\mathrm{d}t^2} \qquad \mathbf{F} = -\boldsymbol{\nabla} U \qquad U = -\int \mathbf{F}\mathrm{d}x$$

$$K = \frac{p^2}{2m} \qquad a_\phi = v^2/r \qquad W = -\Delta U$$

$$\omega = 2\pi f \qquad T = 1/f \qquad k = 2\pi/\lambda$$

1 Gravitation

$$\mathbf{F} = \frac{Gm_1m_2}{r^2}\ \hat{r} \qquad U = -\frac{Gm_1m_2}{r}$$

$$v = \sqrt{2GM/r} \qquad T^2 = \frac{4\pi^2}{GM}r^3$$

2 Fluids

$$P = \frac{F}{A} \qquad P = P_0 + \rho g d$$

$$F_1 = \frac{A_1}{A_2}F_2 + \rho g h A_1 \qquad F_B = \rho_f V_f g$$

$$v_1A_1 = v_2A_2 \qquad P + 1/2\rho v^2 + \rho g h = \text{constant}$$

3 Oscillations

$$x(t) = A\cos wt + \phi \qquad \omega = \sqrt{k/m} \qquad \mathbf{F} = -k\mathbf{x}$$

$$v_{\max} = A\omega \qquad T = 2\pi\sqrt{m/k} \qquad U = 1/2kx^2$$

4 Traveling waves

$$v_{\text{string}} = \sqrt{T_s/\mu} \qquad \mu = m/L \qquad v = \lambda f$$

$$\omega = vk \qquad D(x,t) = A\cos\left(kx + \omega t + \phi\right) \qquad \frac{\partial^2 D}{\partial t^2} = \frac{T_s}{\mu}\frac{\partial^2 D}{\partial x^2}$$

5 Doppler effect

$$f_+ = \frac{f_0}{1 - v_0/v} \qquad \text{approaching source}$$

$$f_- = \frac{f_0}{1 + v_0/v} \qquad \text{receding source}$$

$$f_+ = (1 + v_0/v) f_0 \qquad \text{approaching observer}$$

$$f_- = (1 - v_0/v) f_0 \qquad \text{receding observer}$$